

3. Achieving Attainment Air Quality

Key Points: **[highlighted tables and figures still subject to minor updating]**

- Shows Ozone Monitoring History through (draft) 2002 for Key WI sites
- Confirms Ozone 1999-2001 Monitoring System and Data Validity for WI designated ozone areas
- Confirms Attainment Level Air Quality for Ozone for Door and Manitowoc counties through the 2002 season
- Briefly describe WI and regional trends of air quality improvement over the period 1980-2002

Introduction – Monitoring Attainment Air Quality

Designated ozone nonattainment areas requesting redesignation to attainment status must first show that attainment has been monitored for the area following EPA guidelines. These rules and guidance documents establish monitoring quality and completeness criteria and specify the frequency with which areas can record concentrations greater than the National Ambient Air Quality Standard (NAAQS) for ozone without violating the standard.

Ozone data for the 2000-2002 period are being quality-assured and loaded to the EPA AIRS site. However, the 1999-2001 was fully quality assured at the end of 2001 and is still relevant to the current redesignation request. The draft 2000-2002 data for all Wisconsin sites is presented in **Table 3-1 (Amended - Oct 2002)**. The key 1999-2001 Wisconsin site monitoring data for the Wisconsin designated ozone areas is presented in **Table 3-1a (Amended - May 2002)**.

While all of Wisconsin's nonattainment, maintenance and attainment areas had demonstrated *monitored* attainment of the 1-hr ozone NAAQS at the close of the 2001 ozone season (October 15, 2002), the 2002 ozone season led to renewed violation status for the 6 county Milwaukee nonattainment area, prior to a redesignation request submittal. Based on draft final monitoring data for 2002, only Door and Manitowoc Counties continue to be eligible for redesignation to attainment.

Even with the more numerous "exceedances" (eg – concentration readings above 0.124 ppm) of the 1 hour ozone standard that occurred during the 2002 season at several eastern WI sites, there is still not an air monitoring basis for considering changes to the current attainment maintenance status of Sheboygan, Kewaunee and Walworth counties. Simple trend data presented later in this section indicate a possibility for sporadic exceedance level concentrations, but support 2007 attainment design values. The areas did not reach violation level air quality over either the 1999-2001 or 2000-2002 periods and should continue to show attainment air quality into the future based on the regional attainment demonstration and their updated maintenance plans (exclusive of Walworth).

Table 3-1 (Amended) – 2000-2002 WI Site Design Values ^(a) (Draft Data subject to Q/A)

DV Day Rank	Site Name	Peak 1-hr O3				Site Name	Peak 1-hr O3				Site Name	Peak 1-hr O3			
		Yr	Mo	Day	(ppb)		Yr	Mo	Day	(ppb)		Yr	Mo	Day	(ppb)
1	Appleton	01	6	13	102	Kenosha	02	8	11	141	Newport	01	6	13	125
2		01	6	28	102		02	6	22	135		02	8	10	113
3		01	7	19	94		02	6	23	132		01	7	31	113
4	D.V.=	01	7	18	93	D.V.=	02	6	24	129 (b)	D.V.=	02	9	8	110
1	Beloit	01	6	27	102	Kewaunee	02	6	24	121	Oshkosh	01	6	28	100
2		02	6	9	100		01	7	31	110		01	7	19	96
3		00	8	31	99		02	8	10	104		02	6	9	93
4	D.V.=	02	6	23	98	D.V.=	02	9	8	103	D.V.=	01	6	26	93
1	Chiwaukee	02	6	22	155	Lake Dubay	00	6	9	93	Popple River	01	6	13	100
2		02	8	11	144		02	9	8	85		01	5	20	84
3		02	6	23	134		01	6	28	84		01	6	14	82
4	D.V.=	01	8	8	134(b)	D.V.=	00	5	3	81	D.V.=	02	6	9	81
1	Collins	01	6	13	112	Lake Geneva	02	6	9	117	Racine	02	8	11	143
2		01	7	16	112		01	6	27	110		02	6	22	141
3		01	7	31	109		01	6	13	100		02	6	23	129
4	D.V.=	01	6	14	107	D.V.=	01	6	26	99	D.V.=	02	6	24	125(b)
1	Columbus	02	6	24	95	Madison	00	9	1	99	Sheb_Falls	01	7	31	116
2		02	9	7	94		01	6	27	98		02	8	11	110
3		02	6	9	93		02	6	9	97		01	6	13	110
4	D.V.=	00	6	9	92	D.V.=	02	6	23	90	D.V.=	02	9	8	108
1	Devils	02	6	9	93	Manitowoc	01	6	29	120	Sheboygan	02	6	23	140
2	Lake	00	6	9	89		00	6	9	111		01	7	31	125
3		02	6	18	84		01	8	1	110		02	6	24	124
4	D.V.=	00	6	8	82	D.V.=	01	6	13	109	D.V.=	02	8	10	123
1	Fond du Lac	01	6	13	101	Mayville	01	6	13	99	Slinger	01	6	13	107
2		02	6	9	100		02	6	24	98		02	6	9	103
3		01	7	19	96		02	6	9	94		01	6	27	103
4	D.V.=	02	7	16	94	D.V.=	00	9	1	94	D.V.=	02	9	8	97
1	Grafton	01	7	31	135	Milw-App Av	01	7	31	103	Somerset	01	6	27	105
2		02	9	8	123		01	6	13	96		01	6	26	102
3		02	8	11	121		00	6	8	94		02	6	25	98
4	D.V.=	02	6	23	117	D.V.=	02	6	24	89	D.V.=	02	7	26	96
1	Green Bay	01	6	13	118	Milw- Bayside	01	7	31	127	Waukesha	01	6	28	106
2		01	7	31	107		02	8	11	125		02	6	9	103
3		01	6	28	103		02	6	23	121		00	9	1	103
4	D.V.=	01	6	14	100	D.V.=	02	9	8	120	D.V.=	01	6	13	102
1	Harr. Beach	01	7	31	127	Milw- Blakewd	01	7	31	129	Wildcat Mtn	00	6	9	89
2		01	6	29	117		02	6	23	124		01	4	30	83
3		02	8	11	116		01	8	5	122		02	7	14	81
4	D.V.=	02	6	24	115	D.V.=	02	8	11	121	D.V.=	00	6	8	81
1	Harshaw	01	6	28	87	Milw- DNRSER	01	7	31	121					
2		00	6	9	80		02	8	11	116					
3		01	4	29	79		02	9	8	113					
4	D.V.=	01	6	25	77	D.V.=	02	6	9	112					
1	Jefferson	01	6	26	100	Milw- UWM_N	02	8	11	132					
2		02	6	9	99		02	6	23	127					
3		00	6	8	98		01	7	31	125					
4	D.V.=	02	6	23	97	D.V.=	02	6	9	121					

(a) – 2002 Values subject to final Q/A.

(b) – Areas containing sites with design values greater than 124 reflect violation level air quality and are not eligible for redesignation to attainment. Kenosha, Chiwaukee and Racine are all part of the Milwaukee six county nonattainment area.

Table 3.1a (Amended) documents the 4 highest peak daily 1-hr ozone values during 1999-2001 for each WDNR site that fully operated during this 3-yr period. These values are based upon final, fully quality assured WDNR ozone measurement data that have been submitted to the US EPA AIRS for the full Wisconsin ozone monitoring season (15 April - 15 Oct) for years 1999- 2001. Each such 1-hr O₃ value is designated as the 1-hr ozone "design value" (DV) for that site for the 1999-2001 period (i.e., comparison with respect to the 1-hr O₃ NAAQS of 124 parts per billion [ppb]). The Chiwaukee monitor (Pleasant Prairie) has functioned as the design site for the Chicago (CMSA) nonattainment area since the final designations after the CAA-90. The May 2002 Table 3-1 included all Wisconsin sites. Table 3-1 presented the 2002-2002 draft data for all Wisconsin ozone monitoring sites.

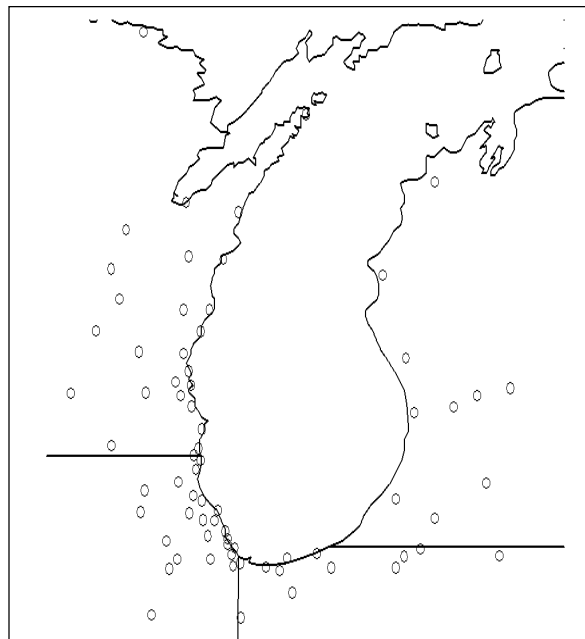
Table 3-1a (Amended from May 2002): Key Wisconsin Ozone Monitoring Sites – 11 Counties Designated Nonattainment for Ozone in 1990 – Fourth Highest Peak Daily 1-Hr Ozone Concentrations from 1999 to 2001
Highest 1999-2002 1-hr Ozone Concentrations* - Wisconsin Ozone Areas

Day Rank	Site Name	Yr	M	Day	Peak Daily 1-hr Ozone (ppb)	Site Name	Yr	M	Day	Peak Daily 1-hr Ozone (ppb)	Site Name	Yr	M	Day	Peak Daily 1-hr Ozone (ppb)
1	Chiwaukee	01	8	8	134	Lake Geneva	99	9	4	123	Newport	01	6	13	125
2	Chiwaukee	99	6	11	126	Lake Geneva	01	6	27	110	Newport	99	9	3	123
3	Chiwaukee	99	9	5	126	Lake Geneva	99	6	21	108	Newport	01	7	31	113
4	Chiwaukee	01	7	31	124	Lake Geneva	01	6	13	100	Newport	99	6	22	112
1	Collins	99	6	22	122	Manitowoc	99	7	16	130	Racine	01	7	31	118
2	Collins	01	7	16	112	Manitowoc	01	6	29	120	Racine	99	9	5	116
3	Collins	01	6	13	112	Manitowoc	99	7	30	115	Racine	01	8	8	115
4	Collins	01	7	31	109	Manitowoc	00	6	9	111	Racine	99	6	11	114
1	Grafton	99	6	11	136	Mil-App Av	99	6	22	107	Sheboygan	99	7	30	132
2	Grafton	01	7	31	135	Mil-App Av	99	5	29	105	Sheboygan	99	7	16	130
3	Grafton	01	7	21	113	Mil-App Av	99	9	5	103	Sheboygan	01	7	31	125
4	Grafton	01	7	16	112	Mil-App Av	01	7	31	103	Sheboygan	01	6	29	122
1	Harr. Beach	99	6	11	137	Mil-Bayside	99	6	11	137	Slinger	01	6	13	107
2	Harr. Beach	01	7	31	127	Mil-Bayside	01	7	31	127	Slinger	99	6	21	104
3	Harr. Beach	99	7	16	122	Mil-Bayside	99	6	9	118	Slinger	99	9	5	104
4	Harr. Beach	01	6	29	117	Mil-Bayside	99	9	5	116	Slinger	01	6	27	103
1	Kenosha	99	9	5	120	Mil-Blakewd	01	7	31	129	Waukesha	99	5	30	110
2	Kenosha	01	7	31	119	Mil-Blakewd	99	9	5	128	Waukesha	99	6	21	106
3	Kenosha	01	8	8	116	Mil-Blakewd	01	8	5	122	Waukesha	01	6	28	106
4	Kenosha	99	6	11	115	Mil-Blakewd	99	6	11	119	Waukesha	99	9	5	104
1	Kewaunee	99	7	16	116	Mil-UWM_N	99	6	11	127					
2	Kewaunee	01	7	31	110	Mil-UWM_N	01	7	31	125					
3	Kewaunee	99	9	3	109	Mil-UWM_N	99	9	5	114					
4	Kewaunee	99	9	2	107	Mil-UWM_N	01	8	5	114					

Each site's draft 4th highest peak daily 1-hr O₃ value of this most recent three-yr period.

Regional Monitoring System Adequacy and Regional Air Quality Design Sites

For a Lake Michigan region, air quality perspective, during the 1999-2001 period, there were 47 ozone monitors located in the nonattainment counties in northwestern Indiana (6), northeastern Illinois (24), and eastern Wisconsin (17) (see **Figure 3.1b**). In addition, there are 27 more ozone monitors located in other counties in the Lake Michigan area (i.e., 6 in northwestern Indiana, 11 in eastern Wisconsin, and 10 in western Michigan).



**Figure 3-1b
Lake Michigan
Region Ozone
Monitors**

Figure 3-1c, contains a regional comparison of the three highest design values within each State for the 1999 – 2001 period. **Appendix 3-1**, referenced in the May 2002 Draft included a full table of regional design values for the period. The data identifies the Wisconsin sites on the western shoreline and the Michigan sites near the eastern shoreline as the key monitors for determining regional 1-hour attainment. Since some of the SE Wisconsin and Michigan sites violated in 2002, only the northern counties remain eligible for redesignation.

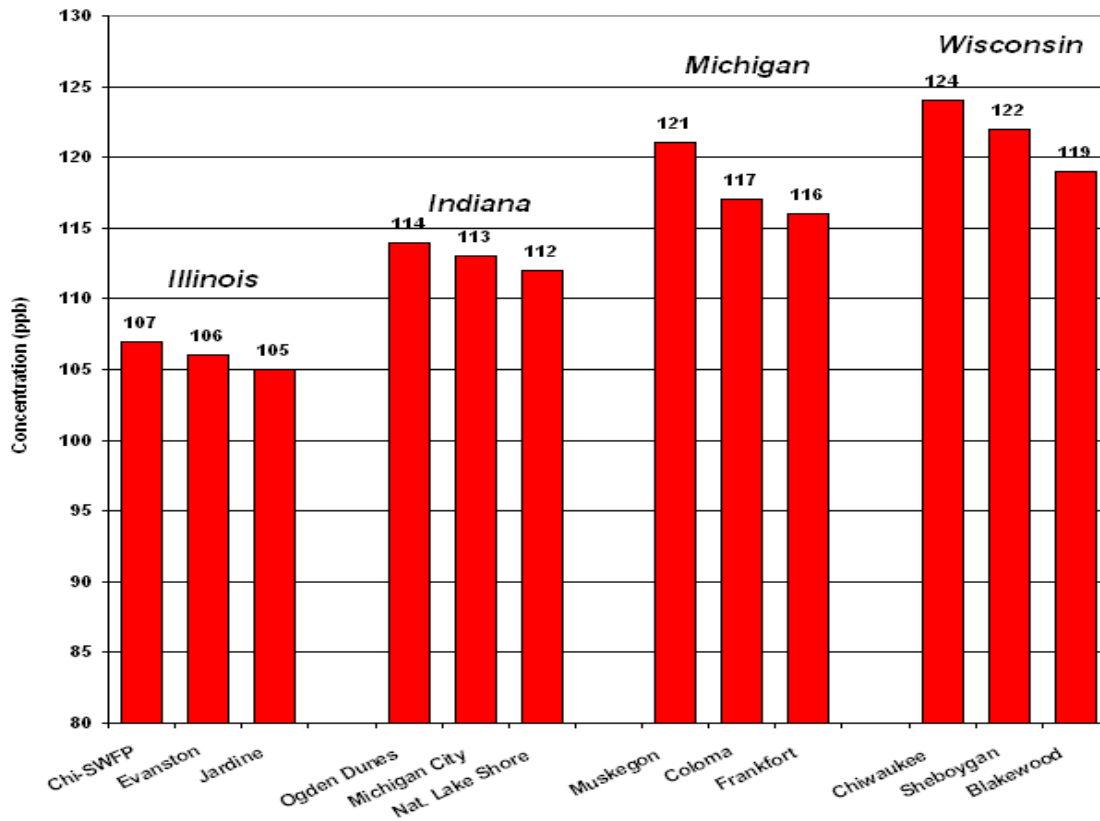


Figure 3-1c – 2001 Design Values for Select Sites in the Lake Michigan Area

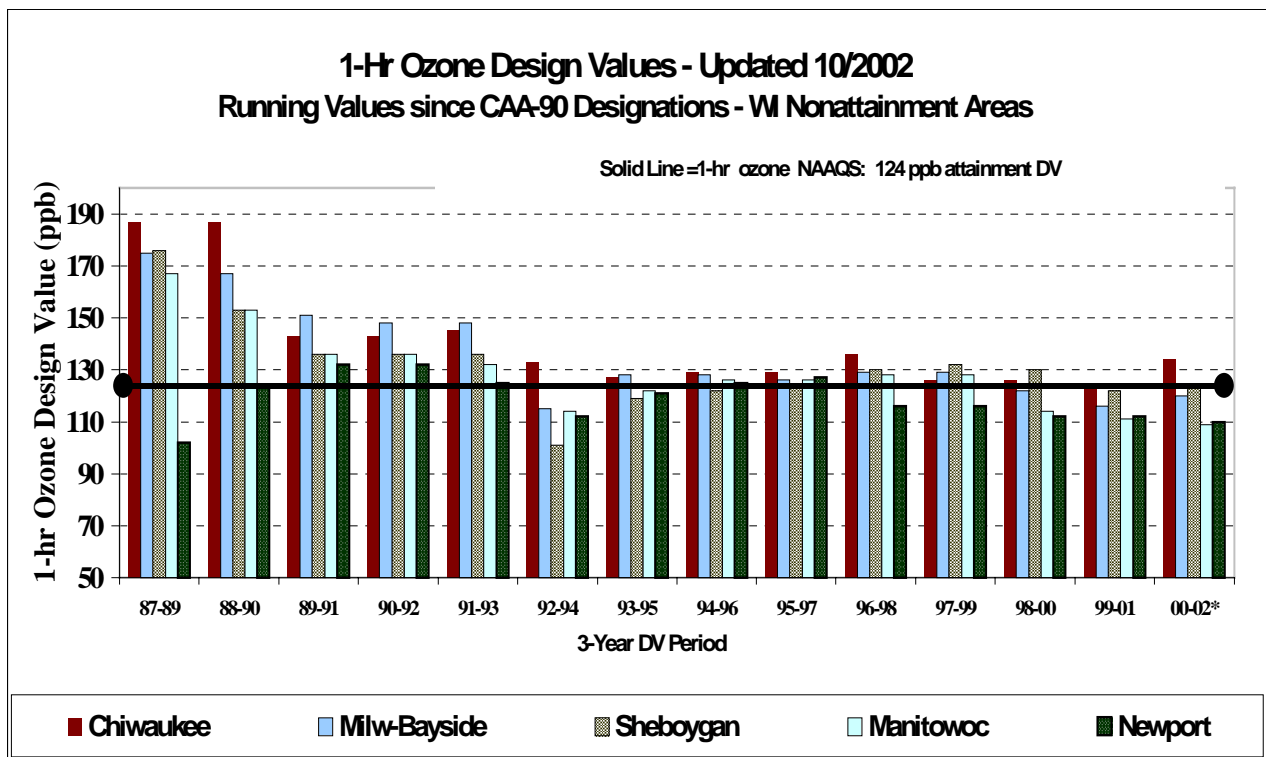


Figure 3-2 highlights a trend of peak value ozone concentration decreases in key nonattainment areas spaced south-to-north along the western shoreline of Lake Michigan. The trend incorporates the time since initial designation under the CAA-90. With the exception of Milwaukee-Bayside, the five identified monitoring sites functioned over that period as the design monitors for the areas considered for redesignation and updated maintenance plans. Some of the counties contain multiple monitors to better assess air quality in the region. However, the noted monitors remain the key air quality indicator unless or until another site exhibits a higher design value for the area in question. As can be seen in the updated proposal (Oct 2002), for Wisconsin, only the 6 county area continues to violate at the close of 2002.

The eastern Wisconsin ozone trend, reflected in the running design values, highlights the changing characteristic of ambient ozone concentration in the region. While all monitors show a rapid decline in peak values over the period, the highest concentrations are slowly shifting downwind from the core metropolitan areas. The Chiwaukee monitor in the township of Pleasant Prairie in Kenosha County is Wisconsin's closest monitor to the greater Chicago metro area. It has always been the highest design value (DV) in the Lake Michigan region and functions as the Chicago metro area design site. By the end of the 1990s, there is a more consistent DV for the entire western shoreline of the lake and the near metro area monitors exhibit concentrations more consistent with the further downwind monitors. The core metro areas, reflected in the Milwaukee monitor noted above along with the Blakewood and UW-M monitors show DVs still depressed in relation to the sites slightly further downwind. In general, the near-lake sites show higher peak concentrations than those further inland.

The ozone geography is consistent with a regional ozone chemistry slowly changing from VOC-dominated to NO_x-dominated. Much of the control programs crafted in the 1980s and 1990s to address local ozone problems have focused on VOC control in the metro areas and in areas with high gasoline transfer rates and high vehicle travel levels. To address the evolving 8-hour ozone problem, more regional control of NO_x is required. For now, for the 1-hour standard, the current local control effort directed mostly at VOC combined with the modest regional NO_x reductions built into the attainment demonstration are expected to maintain the 1-hour standard for the downwind areas redesignating to attainment. This is addressed in Chapter 5 – the Maintenance Plan portion of the redesignation package.

Regional Ozone Air Quality Improvement leading to Attainment

The Lake Michigan Air Directors Consortium (LADCO) found the following trends in a series of recent studies of regional ozone data based on the data through 2001. These were initiated in conjunction with the recent attainment demonstration(s) for IL, IN and WI. Their findings include:

- Since 1981, trends in 1-hour peak concentrations (within the Lake Michigan region as a whole) are generally downward. In the most recent years, however, these trends are flatter.
- Most improvement in 1-hour levels is seen at sites near Lake Michigan in the vicinity of the Chicago-Milwaukee area. Somewhat less improvement is seen at sites farther downwind.
- Trends at regional (background) sites are generally flat and possibly, increasing in recent years.
- Trends in 8-hour peaks are similar to those for 1-hour peaks, with some indication of increasing trends in recent years.

Overall, the LADCO findings demonstrate that 1-hour ozone air quality levels in the Lake Michigan area have improved over the past 20 years, and support the current redesignation of the areas still eligible in the region to attainment/maintenance status for that standard.

Tables 3-2 and 3-3 and **Figures 3-3, 3-4 and 3-5** focus on the regional nature of the eastern Wisconsin ozone problem. **Table 3-2** highlights the steady decline in regional sites in violation of the 1-hour standard for running three year periods starting with 1981-83 (22 sites) and ending with 2000-2002 (4 sites).

Table 3-2 – LADCO Trends Analysis

3-Year Period	Sites in Violation
1981 – 1983	22
1982 – 1984	25
1983 – 1985	25
1984 – 1986	17
1985 – 1987	26
1986 – 1988	28
1987 – 1989	30
1988 – 1990	21
1989 – 1991	13
1990 – 1992	10
1991 – 1993	8
1992 – 1994	1
1993 – 1995	5
1994 – 1996	11
1995 – 1997	12
1996 – 1998	8
1997 – 1999	6
1998 – 2000	2
1999 – 2001	0
2000 – 2002	4

Though relatively stable during the 1980s (with the exclusion of a dip during the cooler 1984-86 period) at 21 to 28 sites, the number of violating sites dropped rapidly in the 1990s. Values for the design years 91-93, 92-94, and 93-95 are depressed somewhat from the longer trend due to cooler and cloudier conditions for the years 92-93. Also, after a slight rise in number of site-violations in the mid-90s, due at least in part to the extended elevated temperatures of 1995, the number of site-violations finally trended lower in the late 1990s into 2001. The 2002 ozone season, with its renewed violations and more frequent site exceedances suggests the improvement trend is not as strong as hoped, but the season still only exhibited 7 days in the region with concentrations above 124 ppb.

Figures 3-3a and b were compiled by LADCO and compare meteorology trends to exceedance level ozone trends for the area through 2001. They highlight the steady decline in proportionate exceedance days relative to the number of elevated temperature days. The figures highlights the summer weather condition impact on relative ozone exceedance frequency over multi-year periods. Average summer conditions are captured through aggregate cooling degree days – a measure of humidity and temperature – and through frequency of regional days with temperatures $\geq 90^{\circ}\text{F}$. The 2002 season reflected some of the most conducive ozone formation conditions in the region in the last several years and matched the 22 days above 90 degrees F that occurred regionally in 1999. However, total site exceedance days only reached 22 occurring over the noted 7 exceedance days. Five of

the 7 days occurred during the major June episode.

Figure 3-3a

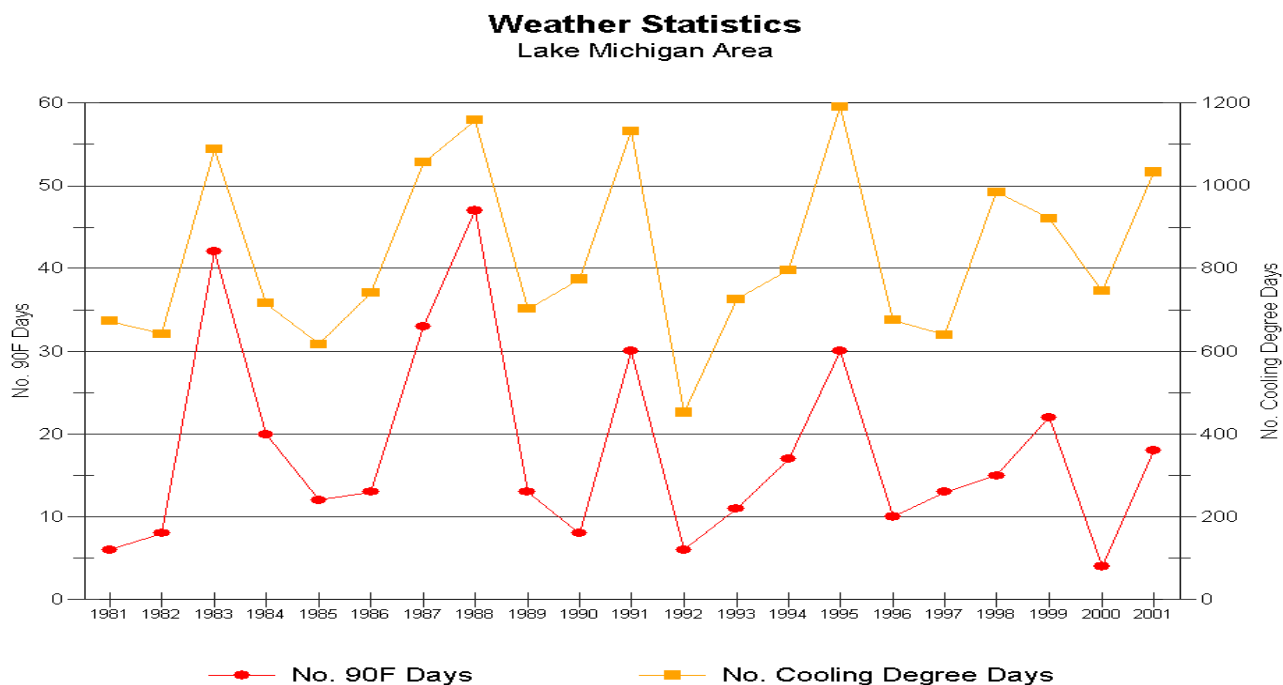
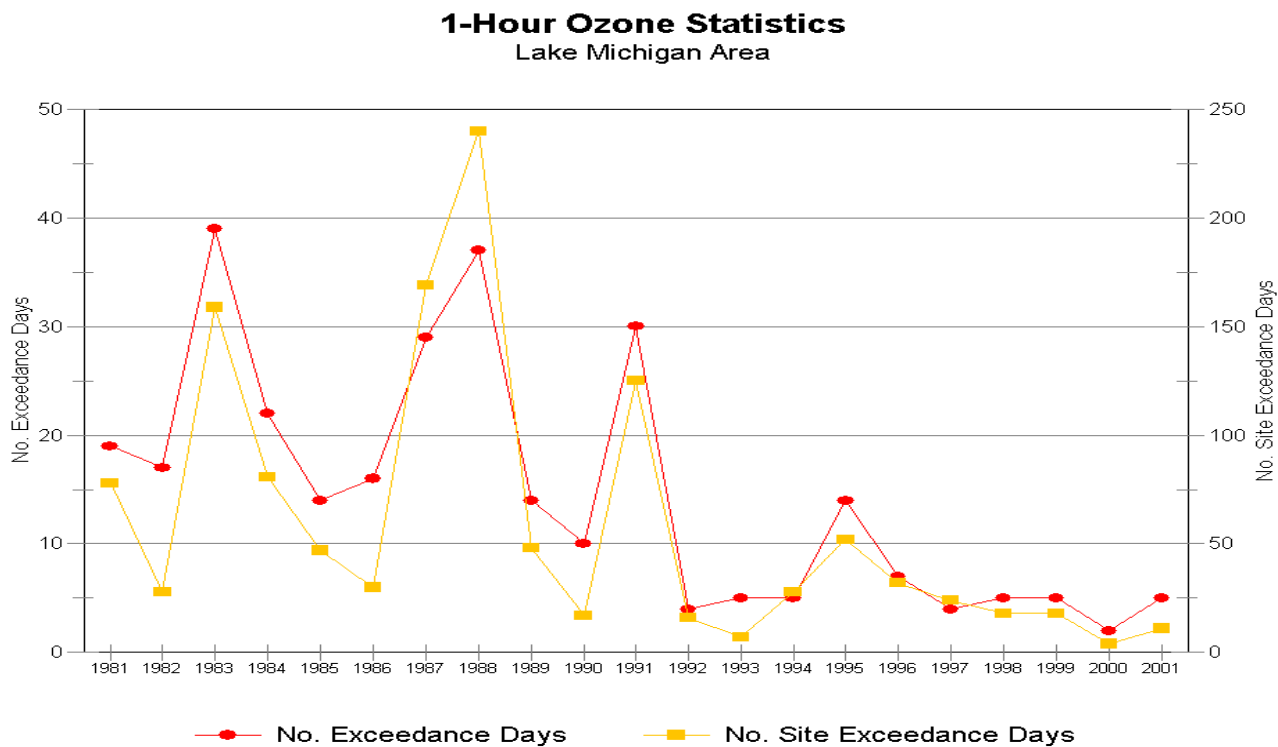
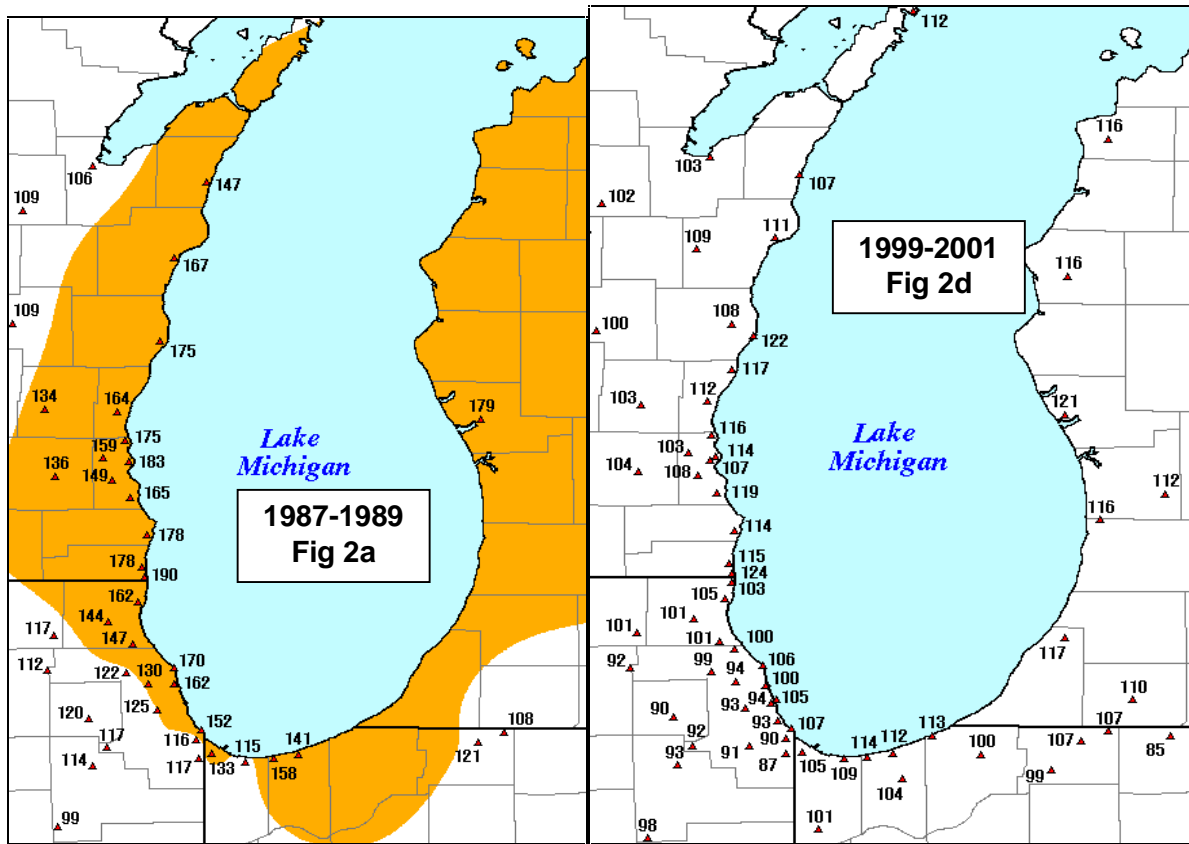
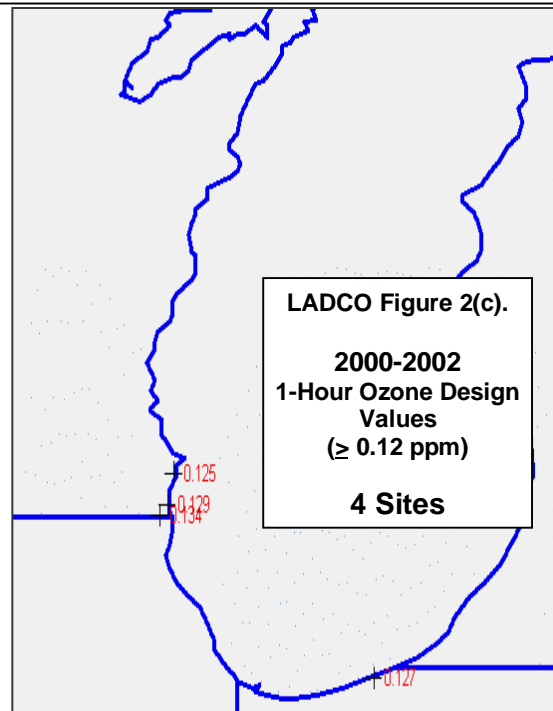
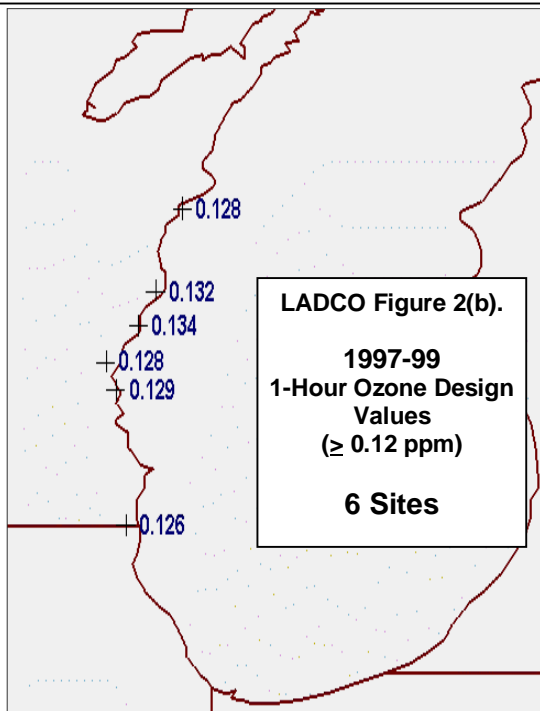


Figure 3-3b





Figures 3-4a,b,c, d [Figure 2a, 2b, 2c, 2d - LADCO and IL Figure 3.3] compare 1-hour design values at violating sites for 1987-89 (the basis for initial designations) compared to a much smaller number of violating sites in 1997-99 and 2000-2002. The third figure shows the DVs for all the noted monitors for 1999-2001. These regional ozone violation site maps show that the spatial extent of ozone violations has decreased considerably over the period, from 30 regional sites in violation in the late 80s to zero sites by 2001 [6,2,0 over the 1997-99, 1998-2000 and 1999-2001 periods]. **While this number increased back to 4 sites during the 2002 ozone season, regression analysis suggests a continued downward trend toward zero violations by 2007.** Combined with Table 3-2 and Figure 3-2, the data show that both initial and subsequent declines in concentration transcended more variable hot weather and meteorology patterns.



Figures 3-5a and b were compiled by LADCO and compare the annualized trend in mean concentrations of NO_x and VOC precursors at the UW-Milwaukee site to its concurrent peak concentrations by year and number of exceedances by year through 1998. Though this precursor monitoring data is only available for one metropolitan site in the region, the trend of relatively strong ambient VOC concentration drop compared to a much more static NO_x concentration highlights the importance of local and regional air chemistry on the monitored ozone levels. More discussion of the importance of this trend occurs in the section on real and permanent reductions.

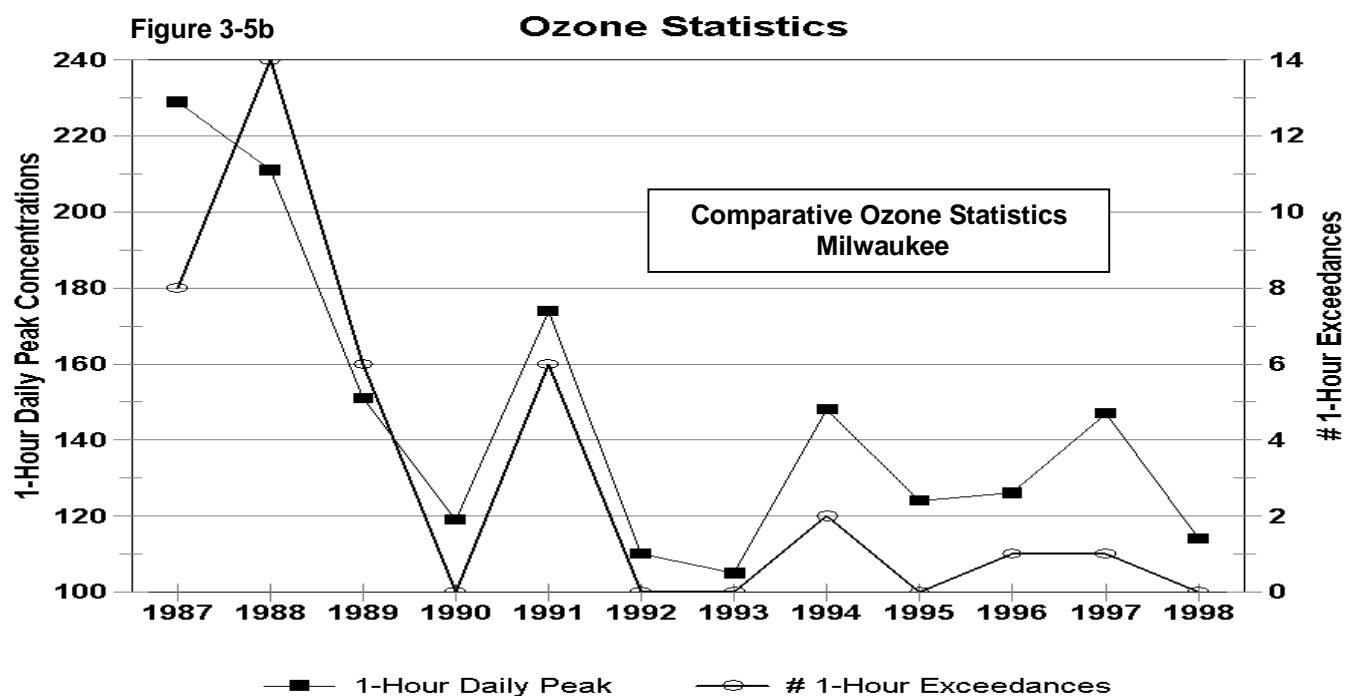
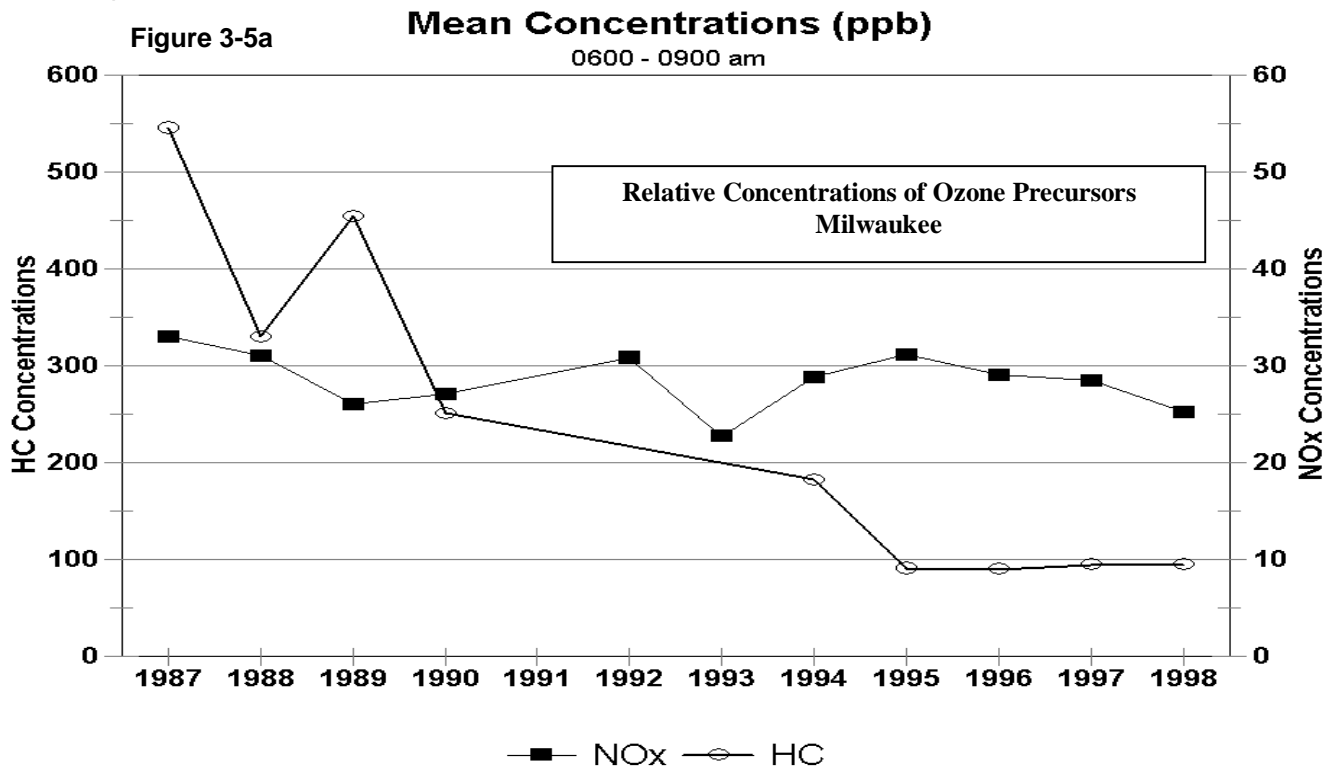


Table 3-3 compiled by LADCO reflects one analysis in a series performed to smooth out a trend in changing ozone values by site over a multi-year period. This table is built from a “Similar Days Approach” analytic technique that qualifies the regional reduction trend by site based on days with roughly equivalent meteorology. It suggests a universally downward trend over the twenty-year period for the metropolitan sites on the western shoreline of the lake. Though only two of the northern areas remain eligible for redesignation, the trends bolster the regional maintenance approach being pursued.

Table 3-3
Summary of 1-Hour Trends Based on Similar Days Approach

<i>Site</i>	<i>Years</i>	<i>Trend (%/year)</i>	<i>p</i>
Wisconsin			
Kenosha	80-99	-1.48	0.01
Racine	80-99	-2.19	< 0.01
Milwaukee-Blakewood	84-99	-1.68	0.05
Milwaukee-Appleton Ave	80-99	-1.03	0.08
Milwaukee-Alverno	84-99	-1.68	0.05
Milwaukee-UWM-North	80-99	-2.25	< 0.01
Milwaukee-Bayside	85-99	-1.37	0.10
Michigan			
<i>Muskegon</i>	<i>80-99</i>	<i>0.18</i>	<i>0.61*</i>
Illinois			
<i>Chicago-SE Police</i>	<i>81-99</i>	<i>-0.25</i>	<i>0.70*</i>
Chicago-Taft	80-99	-2.03	< 0.01
Cicero	82-99	-1.61	< 0.01
Evanston	80-99	-1.14	0.02
Deerfield	80-99	-1.03	0.06
Libertyville	80-99	-0.87	0.08
<i>Waukegan</i>	<i>80-99</i>	<i>-0.75</i>	<i>0.21*</i>

* = not statistically significant

Updated 2002 1-Hour Ozone Trend Analysis for the Key WI Sites

In light of the refined redesignation request and maintenance plan proposals, simple site-based linear regression trends are presented for the areas involved in the Oct 2002 package [Figures 3-6 a, b, c, d] to help assess if attainment maintenance projection remains valid for the post-2002 period for the downwind areas. These trends reflect the last 6 years design values for the Chiwaukee (still reflecting nonattainment status), Sheboygan, Manitowoc and Door County monitors.

Figure 3-6a - Chiwaukee

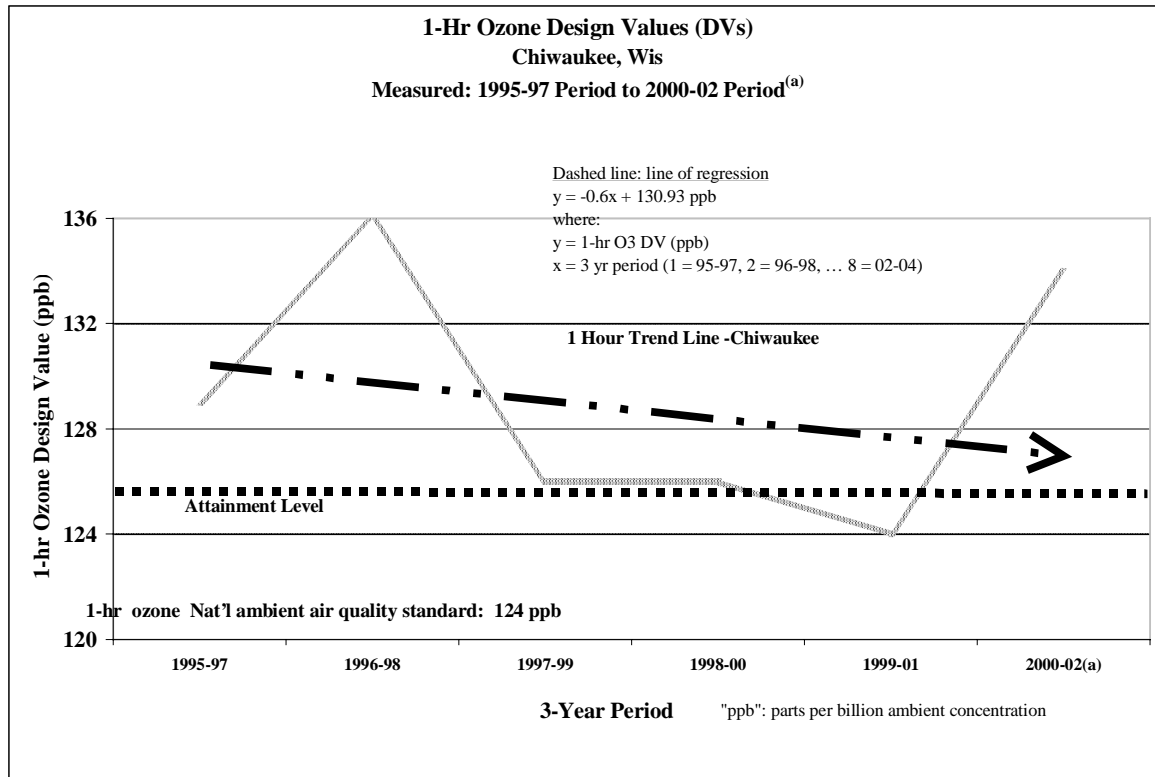
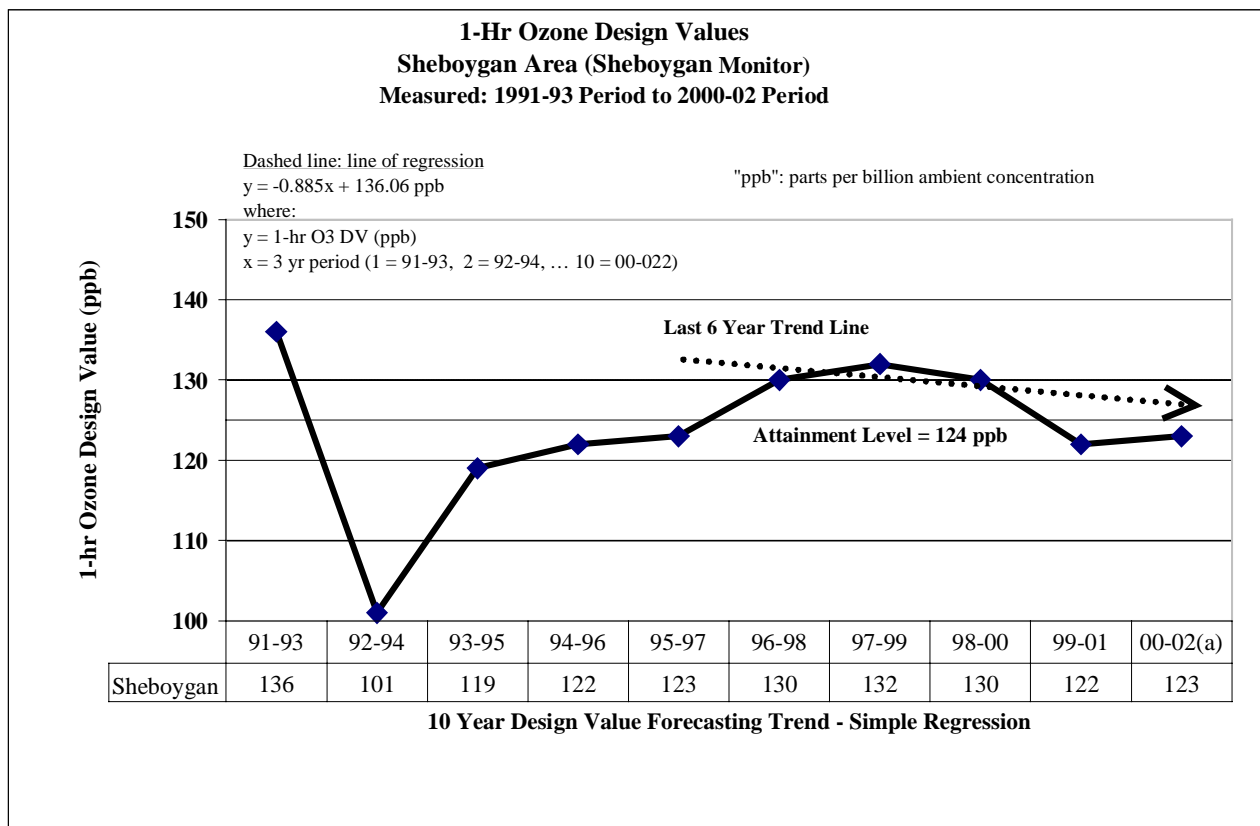
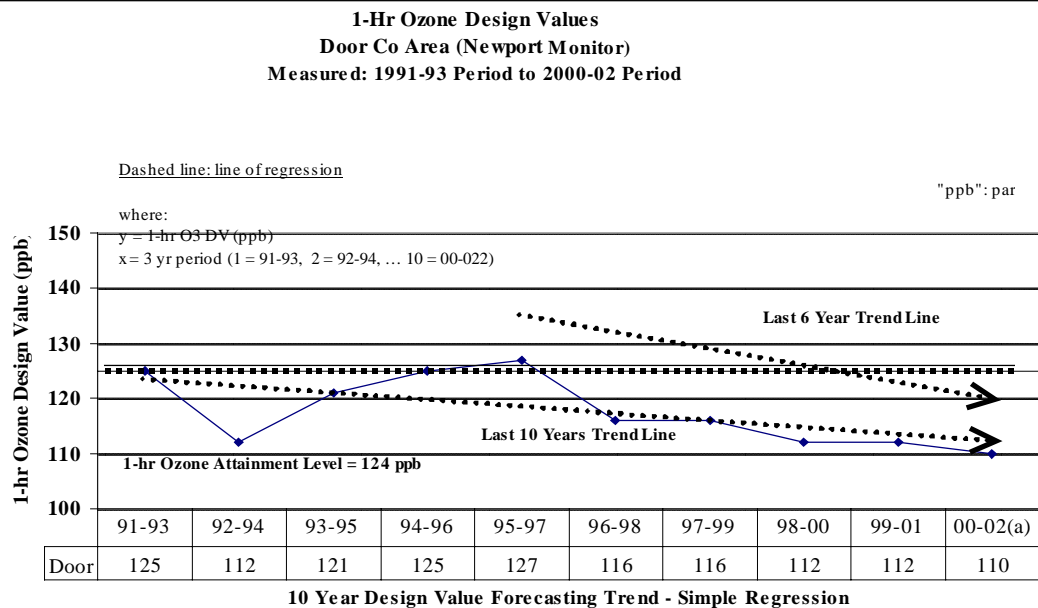
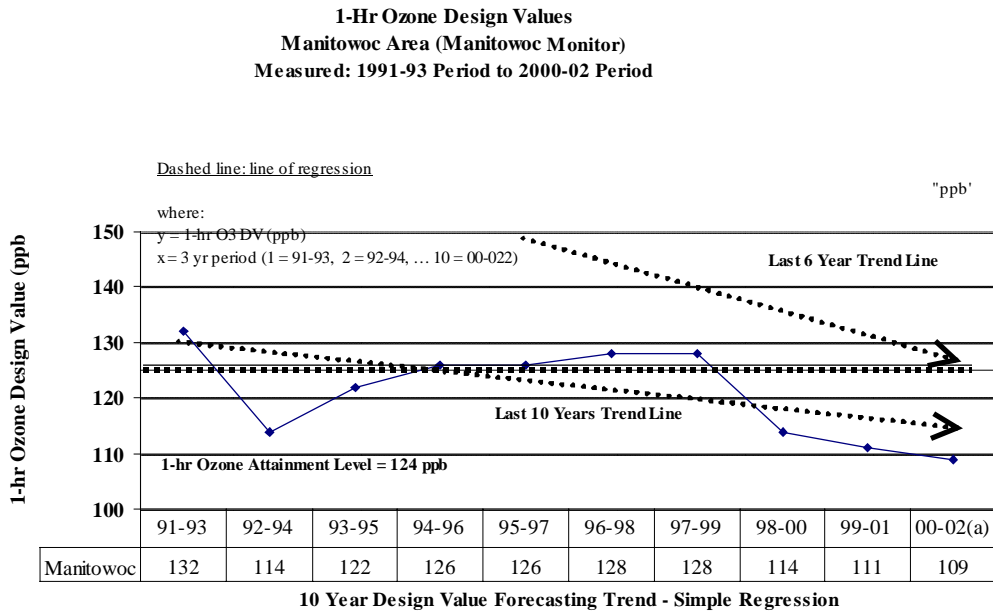


Figure 3-6b





Figures 3c and 3d

Appendix 3-1 – AQ Data and Ozone Trends in the Lake Michigan Area [part of the May 2002 proposal to redesignate the entire region and not included in this draft] provided a comprehensive discussion of regional trends in ozone concentration and the relationship of that trend to geography relative to the Lake and metropolitan areas, regional meteorology during the ozone season and emissions changes over the period for the primary ozone precursors – VOC and NO_x. Later sections in this redesignation package address inventory change assessment related to improved air quality (for Wisconsin) and plans for maintaining the improved air quality levels within the region.